



Currency Substitution and Financial Repression

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Abstract

In this paper, we use a general equilibrium overlapping generations monetary endogenous growth model of a small open economy, to analyze whether financial repression, measured via the “high” mandatory reserve-deposit requirements of financial intermediaries, is an optimal response of a consolidated government following an increase in the degree of currency substitution. We find that higher currency substitution can yield higher reserve requirements, but, the result depends crucially on how the consumer weighs money in the utility function relative to domestic and foreign consumptions, and also the size of the government.

Journal of Economic Literature Classification: E31; E44; E63; F43.

Keywords: Currency Substitution; Endogenous Growth Models; Financial Repression; Small Open Economy; Public Finance.

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1 Introduction

Using a general equilibrium overlapping generations monetary endogenous growth model of small open economy, we analyze the relationship between currency substitution and financial repression. We follow Drazen (1989), Bacchetta and Caminal (1992), Haslag and Hein (1995), Espinosa and Yip (1996), Haslag (1998), Haslag and Koo (1999), Haslag and Bhattacharya (2001) and Gupta (2005, 2006, 2007) amongst others, in defining financial repression through an obligatory “high” reserve deposit ratio requirement, that the banks in the economy needs to maintain. In other words, the study attempts to assay whether there exists a plausible explanation as to why the reserve requirements in some economies are higher than others. Specifically, we analyze whether the “high” reserve requirements in a small open economy characterized by currency substitution, are a fall out of a welfare maximizing decision of the government, having access to income taxation and seigniorage as sources of revenue.

The motivation for believing that currency substitution can be a possible rationale for financial repression, can be outlined as follows: In a small open economy, inflation often leads to currency substitution, which, in turn, tends produce a negative impact on the revenue raised by the government via seigniorage. In such a back drop, our paper analyzes whether increasing the reserve requirements, our metric for financial repression, could be identified as an welfare-maximizing response of the government. This is simply because, the increase in reserve requirements would tend to recuperate the fall in the size of the seigniorage base, that results from substitution of the domestic currency.

Note, financial repression can be broadly defined as a set of government legal restrictions, like interest rate ceilings, compulsory credit allocation and high reserve requirements, that generally prevent the financial intermediaries from functioning at their full capacity level. However, given the wave of interest rate deregulation in the 1980s, and removal credit ceiling some years earlier, the major form of financial repression is currently via obligatory reserve requirements.¹ As Espinosa and Yip (1996) points out the concern is not whether financial repression is prevalent, but the associated degree to which an economy is repressed, since developed or developing economies both resort to such restrictive policies.

Now the pertinent question here is - Why, if at all, would a government want to repress the financial

¹See Caprio *et al.* (2001) for further details.

system ? This seems paradoxical, especially when one takes into account the well documented importance of the financial intermediation process on economic activity, mainly via the finance-growth nexus.² Besides, the fact that “high” cash reserve requirements enhances the size of the implicit tax base and, hence, is lucrative for the government to repress the financial system, an alternative line of thought is derived from the works of Cukierman *et al.*(1992) and Giovannini and De Melo (1993). Both these studies suggested that, countries with inefficient tax systems would be more oriented towards the repression of the financial sector. Roubini and Sala-i-Martin (1995) addresses this issue in a formal fashion, using an endogenous growth framework. They indicated that, governments subjected to large tax-evasion will “choose to increase seigniorage by repressing the financial sector and increasing the inflation rates.”

However, Gupta (2005, 2006), using a pure-exchange- and a production-economy, respectively, in an overlapping generations framework, showed that higher tax evasion would cause a benevolent social planner to optimally increase the tax rates, when implicit taxation is also available as a source of revenue. The optimal reserve requirements, however, continues to be at zero, implying the inability of tax evasion to explain financial repression. But, in a different study, Gupta (2007), when allowed tax evasion to be determined endogenously, showed that higher degree of tax evasion within a country, resulting from a higher level of corruption and a lower penalty rate, yields higher degrees of financial repression as a social optimum. However, a higher degree of tax evasion due to a lower tax rate, results in an increase in the severity of financial restriction.

But, Basu (2001) using a monetary endogenous growth model with productive public capital financed through seigniorage, indicates that the growth- and welfare-maximizing reserve requirement can deviate from zero. Di Giorgio (1999), on the other hand, suggested that the level of reserve requirements are related to the degree of financial development. The author studied a simple productive economy with the process of financial intermediation characterized by a costly state verification problem. As a regulatory policy, the banks are obligated to maintain mandatory reserve requirement on deposits. The analysis indicated that when the cost of monitoring is negligible, the optimal reserve ratio tends to zero. However, beyond a critical level of monitoring cost, the optimal reserve requirement will be different from zero. Furthermore, the

²See Roubini and Sala-i-Martin (1992), and the references cited there in.

optimal reserve requirement was shown to be strictly increasing in the costs of verification of the state. This result highlighted the fact that financially developed economies, which are more likely to have low costs associated with the activities of the financial intermediaries are more prone to have lower optimal reserve requirements than economies with lesser efficient financial systems.

Other attempts to rationalize financial repression has tended to rely on imperfect information and the possibility of banking crisis, for example, the two studies by Gupta (2005, 2006) stated above, when discussing the role of tax evasion and financial repression. Gupta (2005), using an overlapping generations production-economy-monetary model characterized by possibility of banking crisis, shows that economies with higher probability of banking crisis should optimally choose higher income taxation. The correlation between optimal reserve requirements and probability of crisis is positive only when the social planner has exhausted its ability to use income taxation. Similar results were also found by Gupta (2006), based on a pure-exchange overlapping generations model, characterized by information asymmetry between the government and the financial intermediaries. The author showed that a benevolent social planner, maximizing welfare and simultaneously financing the budget constraint, would optimally rely on explicit rather than implicit taxation.

As can be seen from the above discussion, the attempts to explain the existence of financial repression has had a varied degree of success, and has covered the areas of tax evasion, financial development, and, more recently, information asymmetry and bank failures. However, to the best of our knowledge, this is the first study to use currency substitution as a rationale for financial repression. Overall, from a public finance perspective, our study can also be viewed as analyzing optimal policy decisions within a small open economy with currency substitution. In this regard, we extend the recent paper of Holman and Neanidis (2006), by allowing for an additional policy instrument, namely the reserve requirement, beside the income tax rate and the money growth rate, as used in their study.³ Note these authors, studied the growth and welfare effects of explicit and implicit tax rates in a small open economy characterized by currency substitution and tax

³Interestingly, based on the International Financial Statistics of the IMF, the average reserve requirement for the 22 economies considered by Holman and Neanidis (2006) was found to be 22.02 percent over the period of 1980 to 2006. Clearly, the ratio was quite substantial, and cannot be ignored as a monetary policy instrument.

evasion. The remainder of the paper is organized as follows: Section 2 outlines the economic environment and Section 3 defines the equilibrium. Section 4 derives the conditions under which financial repression and currency substitution tends to be positively related as part of a welfare-maximizing outcome, while, Section 5 concludes and lays out the areas of further research.

2 Economic Environment

In this section, the overlapping generations model of Diamond (1965) is modified to depict a financially repressed structure of a small open economy, characterized by currency substitution. The economy is populated by four types of agents, namely, consumers, banks (financial intermediaries), firms and an infinitely-lived government. The following subsections lay out the economic environment in detail, by considering each of the agents separately and accounting for the external sector.

2.1 Consumers

The economy is characterized by an infinite sequence of two-period-lived overlapping generations of consumers. Time is discrete and is indexed by $t = 1, 2, \dots$. At each date t , there are two coexisting generations – young and old. N people are born at each time point $t \geq 1$. At $t = 1$, there exist N people in the economy, called the initial old, who live for only one period. Hereafter N is normalized to 1.

Each agent is endowed with one unit of working time (n_t) when young and is retired when old. The agent supplies this one unit of labor inelastically and receives a competitively determined real wage of w_t . We assume that the agents consume only when old⁴ and, hence, the net of tax wage earnings are allocated between bank deposits and domestic and foreign currencies. Money is held by the consumer because it gives utility. The proceeds from the bank deposits are used to obtain second period consumption. The consumption bundle comprises of a domestically produced good and an imported foreign good. We assume a separable and additive log-utility function in the two goods and composite money. A notable feature of our model is the lack of bonds of any type, either domestic or foreign. In a world of no uncertainty, incorporating

⁴This assumption has no bearing on the results of our model. It makes computations easier and also seems to be a good approximation of the reality. For details see Hall (1988).

bonds in either the consumer portfolio or the bank problem, the latter described in Subsection 2.2, would imply multiplicity of optimal allocations of deposits (or loans) and bonds, since the “no arbitrage” conditions would imply a relative price of one between deposits (or loans) with domestic and foreign bonds.

Formally, the agents problem born in period t is as follows:

$$U(c_{t+1}, c_{t+1}^*, m_{1t}, f_t) = \psi_1 \log c_{t+1} + \psi_2 \log c_{t+1}^* + (1 - \psi_1 - \psi_2) \log[m_{1t}^\lambda f_t^{*(1-\lambda)}] \quad (1)$$

$$p_t d_t + p_t m_{1t} + [e_t p_t^*] f_t^* \leq (1 - \tau_t) p_t w_t \quad (2)$$

$$p_{t+1} c_{t+1} + [e_{t+1} p_{t+1}^*] c_{t+1}^* \leq [1 + i_{dt+1}] p_t d_t + p_t m_{1t} + [e_t p_t^*] f_t^* \quad (3)$$

where $U(\cdot)$ is the utility function, with the standard assumptions of positive and diminishing marginal utilities in both goods and both currencies; ψ_1 , ψ_2 and $[1 - \psi_1 - \psi_2]$ are the weights the consumer assigns to the domestic and foreign goods and the composite money in the utility function; c_{t+1} and c_{t+1}^* are the old age consumption of domestic and foreign goods, respectively; m_{1t} and f_t^* and d_t indicates, in real terms, the consumer's holding of the domestic and foreign currencies and deposits, respectively; λ ($1 - \lambda$) with $0 < \lambda < 1$, captures the weight of domestic (foreign) currency in composite money; τ_t is the tax rate at period t ; w_t is the real wage rate; p_t (p_t^*), is the domestic (foreign) price at period t ; e_t is the nominal exchange rate; and, i_{dt+1} is the nominal interest rate on bank deposits.

The maximization problem of the consumer yields the following optimal choices:

$$c_{t+1} = \psi_1 \left[\frac{1 + i_{dt+1}}{1 + \pi_{t+1}} \right] w_t \quad (4)$$

$$c_{t+1}^* = \psi_2 \left[\frac{1 + i_{dt+1}}{1 + \pi_{t+1}} \right] w_t \quad (5)$$

$$m_{1t} = (1 - \psi_1 - \psi_2) \left[\frac{1 + i_{dt+1}}{i_{dt+1}} \right] \lambda w_t \quad (6)$$

$$f_t^* = (1 - \psi_1 - \psi_2) \left[\frac{1 + i_{dt+1}}{i_{dt+1}} \right] (1 - \lambda) w_t \quad (7)$$

$$d_t = \frac{[(\psi_1 + \psi_2)(1 + i_{dt+1}) - 1]}{i_{dt+1}} \quad (8)$$

We assume that the Purchasing Power Parity (PPP) condition, $p = ep^*$ holds. Since p^* is parametrically given to the small-open economy, we set it to unity without any loss of generality. Hence, implying that the domestic price level and the nominal exchange rates are synonymous for the model economy, with the PPP condition being satisfied, i.e., $p_t = e_t$. Note $\frac{p_{t+1}}{p_t} = \frac{p_{t+1}}{p_t} = 1 + \pi_{t+1}$.

2.2 Financial Intermediaries

At the start of each period, the financial intermediaries accept deposits and make their portfolio decision i.e., loans and cash reserves choices, with a goal of maximizing profits. At the end of the period, they receive their interest income from the loans made and meets the interest obligations on the deposits. Note the intermediaries are constrained by legal requirements on the choice of their portfolio (i.e., reserve requirements), as well as by the feasibility requirement. Given such a structure, the intermediaries obtains the optimal choice for l_t by solving the following problem:

$$\max_{l,d} \pi_{Bt} = i_{lt}l_t - i_{dt}d_t \quad (9)$$

s. to.

$$m_{2t} + l_t \leq d_t \quad (10)$$

$$m_{2t} \geq \gamma_t d_t \quad (11)$$

where π_{Bt} is the real profit of the financial intermediary at time t ; m_{2t} and l_t are, in real-terms, the cash reserves held by the bank and the loans made, respectively; and, γ_t is the reserve-deposit ratio. The reserve requirement ratio is the ratio of required reserves (which must be held in form of currency) to deposits.

To gain some economic intuition on the role of reserve requirements, our metric for financial repression, let us consider the solution of the problem for a typical intermediary. Free entry, drives profits to zero and we have:

$$i_{lt}(1 - \gamma_t) - i_{dt} = 0 \quad (12)$$

Simplifying, in equilibrium, the following condition must hold

$$i_{lt} = \frac{i_{dt}}{1 - \gamma_t} \quad (13)$$

Reserve requirements, thus, tend to induce a wedge between the interest rate on savings and the lending rate for the financial intermediary.

2.3 Firms

All firms are identical and produces a single final good using a constant returns to scale, Cobb-Douglas-type, production function, given as follows:

$$y_t = Ak_t^\alpha (n_t \bar{k}_t)^{1-\alpha} \quad (14)$$

where y_t is the output; n_t is the hours of labor supplied inelastically to production in period t ; k_t is the per-firm capital stock in period t ; \bar{k}_t denotes the aggregate capital stock in period t ; A is a positive scalar, and; $0 < \alpha < 1$, is the elasticity of output with respect to capital. Following, Romer (1986), the aggregate capital stock enters into the production function (15) to account for a positive externality indicating an increase in labor productivity as the society accumulates capital stock. It must be noted that in equilibrium, $k_t = \bar{k}_t$.

At time t the final good can either be consumed or stored. Firms operate in a competitive environment and maximize profit taking the wage rate, the rental rate on capital and the price of the consumption good as given, besides, \bar{k}_t . The producers use the available bank loans, l_t , to purchase capital. This is because a firm starts each period with no cash, since free entry and exit in the perfectly competitive product market washes out all profits. Notice that the production transformation schedule is linear so that the same technology applies to both capital formation and the production of consumption goods, and, hence, both investment and consumption goods sell for the same price p_t .

Formally, the firms face the following problem:

$$\pi_{Ft} = \max_{k_t, n_t} \sum_{i=0}^{\infty} \rho_t \left\{ p_t Ak_t^\alpha (n_t \bar{k}_t)^{1-\alpha} - p_t w_t n_t - i_{t-1} p_{t-1} l_{t-1} + p_t l_t - p_t i_{k_t} - p_{t-1} l_{t-1} \right\} \quad (15)$$

s. to.

$$p_{t-1} k_t \leq p_{t-1} l_{t-1} \quad (16)$$

$$k_{t+1} \leq (1 - \delta_k) k_t + i_{k_t} \quad (17)$$

where π_{Ft} is the discounted stream of profits for the typical firm; and, ρ_t is the subjective discount factor used by the firms. Note that the loan constraint, equation (16), implies that from the firm's point of view,

it may as well be renting the capital from the bank itself. Moreover, the loans are strictly one period loans. Because of these assumptions, as pointed out by Chari *et al.* (1995), the firm can be seen as facing a static problem. Hence, one of the implications of the equilibrium conditions of this version of the model is that the choice of ρ_t is immaterial.

The up-shot of the above static problem of the firm yields the following efficiency conditions:

$$k_t \quad : \quad A\alpha + (1 - \delta_k) = \frac{1 + i_{t-1}}{1 + \pi_t} \quad (18)$$

$$(n_t) \quad : \quad A(1 - \alpha)k_t = w_t \quad (19)$$

Equation (18) suggests that the production firm sets its marginal product of the capital good equal to the real rental, while (19), simply states that the firm hires effective labor up to the point where the marginal product of labor equates the real wage. Note, we are using the fact that in equilibrium: $n_t = 1$ and $k_t = \bar{k}_t$ holds.

2.4 Government and the External Sector

In this subsection, we describe the activities of an infinitely-lived government. The government purchases g_t units of the consumption good and is assumed to costlessly transform these one-for-one into what are called “government good”. The “government good” is assumed to be useless to the agents. The government finances these purchases by income taxation and printing of fiat money. Formally, the government’s budget constraint at date t can be defined as follows:

$$p_t g_t = \tau_t p_t w_t + [M_t - M_{t-1}] \quad (20)$$

where $M_t = p_t(m_{1t} + m_{2t})$: is the total money in circulation in nominal terms. We assume that money evolves according to the policy rule $M_t = (1 + \mu_t)M_{t-1}$, where $\mu(>0)$ is the money growth rate.

Finally, the balance of payments identity of this economy, assuming that (PPP), i.e., $p = ep^*$ holds for all t , and that there are no transactions in the capital account, is given by:

$$x_t - c_t^* = 0 \quad (21)$$

where x_t is the export. The identity, given by equation (21), implies that the trade surplus ($x_t - c_t^*$) has

to be equal to zero. Without any loss of generality and maintaining consistency with perpetual growth, the exports of the economy, x_t , will be assumed to be a fixed fraction, φ , of the domestic output. Alternatively, (21) becomes:

$$\varphi y_t = c_t^* \quad (22)$$

3 Equilibrium

A valid perfect-foresight, competitive equilibrium for this economy is a sequence of prices $\{p_t, e_t, i_{dt}, i_{lt}\}_{t=0}^{\infty}$, allocations $\{c_t, c_t^*, n_t, i_{kt}\}_{t=0}^{\infty}$, stocks of financial assets $\{m_{1t}, m_{2t}, d_t, f_t^*, l_t\}_{t=0}^{\infty}$, exogenous sequences of $\{p_t^*\}_{t=0}^{\infty}$, and policy variables $\{\tau_t, \gamma_t, \mu_t\}_{t=0}^{\infty}$ such that:

- Taking i_{dt} , τ_t , w_t , e_t and p_t , the consumer optimally chooses c_{t+1} , c_{t+1}^* , d_t , m_{1t} and f_t^* , such that (1) is maximized subject to (2) and (3);
- The stock of financial assets, m_{2t} and l_t , solve the bank's date- t profit maximization problem, (9), subject to (10) and (11), given prices and policy variables.
- The real allocations solve the firm's date- t profit maximization problem, (15), subject to (16) and (17), given prices and policy variables.
- The goods, money, loanable funds, labor and the bond market equilibrium conditions are satisfied for all $t \geq 0$.
- The government budget, equation (20), is balanced on a period-by-period basis.
- The equilibrium condition in the external sector requires, equation (22) to holds, along with the PPP condition being satisfied for all $t \geq 0$.
- i_{dt} , i_{lt} , d_t , m_{1t} , m_{2t} , f_t^* , $p_t = e_t$ and p_t^* must be positive for all $t \geq 0$.

4 Currency Substitution and Optimal Policy Decisions

In this section, we analyze whether higher degree of currency substitution would result in an increase in the degree of financial repression within a specific country. In our case, this implies studying whether the optimal choice of the reserve-deposit ratio (γ_t) increases following a decrease in λ (the share of domestic currency in composite money). For this purpose, we analyze the behavior of a social planner who maximizes the utility of all consumers, by choosing τ_t , γ_t and μ_t following changes in λ , subject to the set of inequality constraints: $0 \leq \tau_t \leq 1$, $0 \leq \gamma_t \leq 1$, and $\mu_t \geq 0$ and also the government budget constraint, equation (20), evaluated at steady-state. Note for the sake of simplicity, as in Basu (2001), we assume that the social planner follows time invariant policy rules. Hence, $\tau_t = \tau$, $\gamma_t = \gamma$ and $\mu_t = \mu$.

Using (4), (5), (6), (7), (8), (13), (16), (18) and (19), we obtain the following structure for the social planner's problem:

$$\max_{\tau, \mu, \gamma} W = \sum_{t=0}^{\infty} \beta^t U(c_{t+1}, c_{t+1}^*, m_{1t}, f_t^*) \quad (23)$$

$$\max_{\tau, \mu, \gamma} W = \left\{ \begin{array}{l} \frac{\Omega}{1-\beta} + \frac{\beta \log(1+\theta)}{(1-\beta)^2} + \frac{\log(1-\tau)}{1-\beta} + \frac{\log(w_0)}{1-\beta} + \\ \frac{1+(1-\gamma)}{(1-\gamma)} \frac{-1+\frac{(1+\mu)(1+A\alpha-\delta_k)}{1+\theta}}{-1+\frac{(1+\mu)(1+A\alpha-\delta_k)}{1+\theta}} (1-\psi_1-\psi_2) \\ \frac{\log(\frac{1+(1-\gamma)}{(1-\gamma)} \frac{-1+\frac{(1+\mu)(1+A\alpha-\delta_k)}{1+\theta}}{-1+\frac{(1+\mu)(1+A\alpha-\delta_k)}{1+\theta}})}{1-\beta} + \\ \frac{\log(\frac{\gamma(1+\theta)}{1+\mu} + (1-\gamma)(1+A\alpha-\delta_k)) (\psi_1+\psi_2)}{1-\beta} \end{array} \right\} \quad (24)$$

s. to.

$$(i) \phi = \tau + \frac{\mu(1-\tau)}{1+\mu} \left\{ \begin{array}{l} \frac{\lambda(1+\gamma\theta+\mu-\gamma\mu-A\alpha(-1+\gamma)(1+\mu)+(-1+\gamma)(1+\mu)\delta_k)(-1+\psi_1+\psi_2)}{(-1+\gamma)(-\theta+\mu+A\alpha(1+\mu)-(1+\mu)\delta_k)} + \\ \gamma \left(1 - \frac{(1+\gamma\theta+\mu-\gamma\mu-A\alpha(-1+\gamma)(1+\mu)+(-1+\gamma)(1+\mu)\delta_k)(-1+\psi_1+\psi_2)}{(-1+\gamma)(-\theta+\mu+A\alpha(1+\mu)-(1+\mu)\delta_k)} \right) \end{array} \right\} \quad (25)$$

$$(ii) 0 \leq \tau \leq 1 \quad (26)$$

$$(iii) \mu \geq 0 \quad (27)$$

$$(iv) 0 \leq \gamma \leq 1 \quad (28)$$

where, $\Omega = \frac{\log(\psi_1)\psi_1 + ((1-\lambda)\log(1-\lambda) + \lambda\log(\lambda))(1-\psi_1-\psi_2) + \log(\psi_2)\psi_2}{1-\beta}$; and consistency with endogenous growth,

which requires all real variables to grow at the same rate (θ) in steady-state, allows us to use the fact that

$w_t = (1+\theta)^t w_0$, with w_0 being the initial value of the real-wage, and also set: $\phi = \frac{g_t}{w_t}$. Further, using (18),

we obtain $w_0 = A(1-\alpha)k_0$, where k_0 is the initial level of per-capita capital stock. Without any loss of

generality, we normalize k_0 to unity. θ , in turn, is given by the following expression:

$$\theta = \frac{1}{2} \left\{ \begin{array}{l} 1 + A + \mu + A\alpha\mu - A\tau + A\alpha\tau - \delta_k - \mu\delta_k - A\gamma\psi_1 + A\alpha\gamma\psi_1 + \\ A\gamma\tau\psi_1 - A\alpha\gamma\tau\psi_1 - A\gamma\psi_2 + A\alpha\gamma\psi_2 + A\gamma\tau\psi_2 - A\alpha\gamma\tau\psi_2 - (\eta)^{(\frac{1}{2})} \end{array} \right\} - 1 \quad (29)$$

$$\text{where } \eta = \left\{ \begin{array}{l} 4A(-1+\alpha)(-1+\gamma)(1+\mu)(-1+\tau)(1+A\alpha-\delta_k)(\psi_1+\psi_2) + \\ (1+A+\mu+A\alpha\mu-A\tau+A\alpha\tau-(1+\mu)\delta_k+A\gamma(-1+\alpha+\tau-\alpha\tau)\psi_1-A\gamma\psi_2+A\alpha\gamma\psi_2+A\gamma\tau\psi_2-A\alpha\gamma\tau\psi_2)^2 \end{array} \right\}$$

The problem of the social planner which comprises of maximizing (24) subject to (25), (26), (27) and (28), is non-linear in τ , μ and γ , and requires numerical values for the parameters of the model to obtain the optimal values of the policy variables.⁵ The parameter values, except for the weights of the utility function (ψ_1 , ψ_2 and $(1-\psi_1-\psi_2)$), has been derived from Zimmermann (1994), Chari *et al.* (1995), Haslag and Young (1998), Basu (2001) and Holman and Neanidis (2006). Further, given the parameter values, and alternative values for ψ_1 and ψ_2 and, hence, $(1-\psi_1-\psi_2)$, we calibrate the values of A required to produce a growth rate of 2 percent⁶. The use of alternative values for the parameters defining the weights of the variables in the utility function is warranted not only since no distinct values for such parameters are available in the literature, but, more importantly, because this allowed us to check how sensitive our results are to the choice of ψ_1 and ψ_2 . The chosen and the calibrated parameter values can be categorized into four and are summarized as follows⁷:

Preference: $\psi_1 = 0.70$ [0.35], $\psi_2 = 0.25$ (0.10), $\lambda = 0.80$ and 0.70 , $\beta = 0.98$;

Production: $\alpha = 0.40$, $A = 2.94$ (4.01) [6.27], $\delta_k = 0.10$;

Policy: $\tau = 0.20$, $\mu = 0.15$, $\gamma = 0.20$; $\phi = 0.33$ ⁸.

In this regard, it is important to point out that, as is often observed with monetary endogenous growth models in an overlapping generations framework, we obtained two steady-state growth paths.⁹ For our

⁵All the calculations were carried out using the NMaximize routine in Mathematica 5.0.

⁶The World Development Indicators (published by the World Bank), suggests that the per-capita world growth rate, in recent times, has tended to vary between 1.5 percent to 2.5 percent. We choose 2 percent, simply as an average of this range.

⁷It must be pointed out that, for the sake of simplicity and without any loss of generality, we have converted the parameter values obtained from the five studies, mentioned above, to their nearest multiple of 5. As long as the framework is retained, the qualitative results of our analysis continues to hold irrespective of the values chosen for these parameters.

⁸Note this value of ϕ ensures a government-size of 20 percent, a figure widely encountered in the literature. See Bhattachary and Haslag (2001) for further details.

⁹See Espinosa and Yip (1999) for further details.

analysis, the negative root, as defined by (29), was chosen, since, for the given parameter values, while trying to match a growth rate of 2 percent, the positive root yielded a negative value for A , the production scalar. Hence, the positive root for θ was discarded.

Columns 2, 3 and 4, and 5, 6 and 7 of Table 1 compares the optimal values of the tax-rate (τ^*), the money growth-rate (μ^*) and the reserve requirement (γ^*) respectively, for an increase in the degree of currency substitution, or more precisely, for a fall in the value of λ from 0.80 to 0.70. Note, we repeat the experiment for alternative values of the parameters defining the weights in the utility function. Specifically, we start off with a case where the weight on domestic consumption (ψ_1) exceeds the weight on the foreign consumption (ψ_2), which, in turn, is greater than the weight on composite money ($1-\psi_1 - \psi_2$). In the second scenario, we set $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$, implying that the consumer values aggregate money more than the foreign consumption, but not more than domestic consumption. Finally, we look, at a situation where, $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$, i.e., composite money is valued more than both domestic and foreign consumption, with the domestic good valued more than the foreign good. Note, we also looked at the above three cases with $\psi_2 > \psi_1$, by switching the weights on ψ_1 and ψ_2 used above. Understandably, due to the symmetric nature of the consumer's problem, the corresponding results under the three scenarios, as discussed in Table 1, remained quantitatively unchanged. The results in columns 2, 3 and 4, and 5, 6, and 7, can be visualized as the changes in optimal policies within an economy for an increase in the degree of currency substitution, under different weights imposed on the arguments of the utility function. Alternatively, the comparisons of the results can also be interpreted as the optimal policy decisions of two different economies having exactly the same parameters, but with the exception of the degree of currency substitution.

[INSERT TABLE 1 HERE]

As can be seen from Columns 2, 3 and 4 and 5, 6 and 7 of Table 1, irrespective of the weight assigned by households on domestic consumption, foreign consumption and composite money. Higher currency substitution, always leads to higher optimal values of the reserve requirement. Moreover, when the weight on domestic consumption exceeds the weight on the foreign consumption, which, in turn, is greater than the weight on composite money, i.e, $\psi_1 > \psi_2 > (1-\psi_1 - \psi_2)$ and when $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$, i.e., composite

money is valued more than both domestic and foreign consumption, with domestic good valued more than the foreign good as shown in Row 5 of Table 1, an increase in the degree of currency substitution, causes the optimal money growth rates to fall but the optimal tax rates to increase. But, when the consumer values composite money more than the foreign consumption, but not more than domestic consumption, i.e., $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$ as depicted in Row 4 of Table 1, we find that an increase in currency substitution produces exactly the opposite result to the one obtained above for the money growth rate and taxes. Specifically speaking, the optimal money growth rate increases, while the optimal tax rate falls. Two aspects of the results obtained needs to be stressed: First, the optimal money growth rates, under the different situations, generally tends to be very high. However, such a result is not uncommon in monetary growth models based on an overlapping generations framework.¹⁰ Second, what is more important for our analysis, is the movements of the optimal policy parameters following changes in the degree of currency substitution, rather than their values *per se*.¹¹

To check for the robustness of our results, we decided to reduce the value of ϕ to 0.25, and then to 0.20, implying government-sizes of 15 percent and 12 percent, respectively. In the first case, we find that higher currency substitution now leads to higher financial repression in two of the three scenarios of weights discussed above, i.e., for $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$ and $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$ holds. When the government size is reduced further to 12 percent, currency substitution and financial repression are positively correlated only when $\psi_1 > \psi_2 > (1-\psi_1 - \psi_2)$. So clearly the size of the government matters. For smaller government sizes, higher currency substitution is always accompanied by higher money growth rates, while the tax rate remains same, increases and decreases depending, respectively, on whether the consumer values money more than the consumption goods, one consumption good is valued more than composite money and both the

¹⁰For example see were also obtained by Freeman (1987) and Gupta (2005, 2006, 2007). Also refer to Bhattacharya and Haslag (2001) for a nice exposition as to how this issue can be handled.

¹¹Note, changes in the inflation tax will tend to change the nominal interest rates, and hence, in turn, affect money demand. So clearly there exists certain trade off issues here. However, the change in the money demand is an indirect effect emerging from the changes in the rate of inflation, and would not supercede the change in the inflation tax rate in itself. In this paper, we are essentially analyzing the movements of the economy from one steady-state to another and not the transitional dynamics, thus, the analysis of the movements of the endogenous variables post the change in government policies, following changes in the degree of currency substitution, has been ignored.

consumption goods exceed the weight on money. For middle-sized government, when $\psi_1 > \psi_2 > (1-\psi_1 - \psi_2)$, money growth rate falls, while, tax rates increases for a decrease in the value of δ . When $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$, higher currency substitution causes both money growth rates and the tax rate to fall, and finally when, $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$ money growth rate rises and tax rates fall for an increase in the degree of currency substitution.

So, as far as the relationship between currency substitution and financial repression is concerned, we can draw the following conclusions from the results obtained above:

- Higher currency substitution within a particular economy or across two similar economies (differing only in terms of the share of foreign currency in aggregate money), can cause higher degrees of financial repression;
- With bigger sizes of the government, irrespective of how the consumer values domestic and foreign goods and composite money, higher currency substitution always causes higher financial repression;
- With mid-sized governments, higher currency substitution can also cause higher financial repression, but now the consumer has to value composite money more than at least one kind of consumption good;
- Finally, with governments of relatively small sizes, higher currency substitution and reserve requirements are positively related only when the consumer puts more weight on the consumption of domestic and foreign goods than composite money.

5 Conclusions and Areas of Further Research

This paper, using a general equilibrium overlapping generations monetary endogenous growth model of a small open economy, analyzes the relationship between currency substitution and financial repression. Following other studies in the literature, we define financial repression through an obligatory “high” reserve deposit ratio requirement, that the banks in the economy needs to maintain. In other words, this study attempts to assay whether currency substitution can provide a rationale for financial repression. Specifically, we analyze whether the “high” reserve requirements in a small open economy characterized by currency

substitution, are a fall out of a welfare maximizing decision of the government, having access to income taxation and seigniorage as sources of revenue.

We find that, higher currency substitution within a particular economy or across two similar economies, differing only in the degrees of currency substitution, can cause higher degrees of financial repression, with the results depending on the size of the government and what weights the consumer assigns to the domestic and foreign goods and the composite money. We find that relatively big-size of the government is both necessary and sufficient to produce higher financial repression following an increase in the degree of currency substitution. For middle-sized government sufficiency requires the consumer to value composite money more than at least one kind of consumption good, while with smaller-sized government, currency substitution and financial repression are positively correlated only when the consumer puts more emphasis on the consumption of domestic and foreign goods than composite money.

A limitation of the existing study, as in Holman and Neanidis (2006), is that it does not endogenize currency substitution.¹² The fact that, currency substitution, mainly arises due to high inflation, and hence, should be ideally treated as endogenous, has been ignored in this study. In our economic model, it is as if to say, that high and continuous inflation episodes have resulted in a certain steady-state level of currency substitution for the economy, and, hence, the same can be treated as exogenous. Moreover, endogenizing currency substitution, would not have allowed us to carry out the existing analysis of optimal policy responses, following a change in the share of the foreign currency in aggregate money. Once currency substitution is endogenized, we would, in turn, have to analyze the optimal policy changes following variations in the structural parameters determining the steady-state level of currency substitution, originating from possibly high money growth rates. But then, in a welfare maximizing set-up with a government responding to higher degrees of currency substitution resulting from higher money growth rates, would amount to the government not being able to use money growth rate as an instrument, simply because further changes in the money growth rate would now cause the degree of currency substitution to change again. So, in the context of our current economic environment, the government will now be left with only the reserve requirements and tax

¹²Gupta (2007) raises similar concerns about studies treating tax evasion as exogenous and analyzing optimal responses of government policies following changes in the exogenous degree of tax evasion.

rates as its policy instruments. Nevertheless, this could be an interesting extension. Moreover, it would be worthwhile to repeat the existing analysis by allowing government expenditures to be productive, along the lines of Barro (1990).

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Table 1: **Optimal Policy Decisions:**

Scenarios	$\lambda = 0.80$			$\lambda = 0.70$		
	τ^*	μ^*	γ^*	τ^*	μ^*	γ^*
(i) $\psi_1 > \psi_2 > (1-\psi_1 - \psi_2)$	30.52	161.06	0.01	30.56	83.20	0.03
(ii) $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$	2.97	33914.90	18.76	3.65×10^{-2}	35226.40	23.84
(iii) $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$	0.00	77775000	1.67	2.26	54428880.00	5.75
(iv) $\psi_1 > \psi_2 > (1-\psi_1 - \psi_2)$	17.59	23172.90	4.00	22.10	5381.94	0.26
(v) $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$	10.26	58231.70	0.54	0.16	16419.40	13.73
(vi) $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$	0.01	161.90	2.08×10^{-3}	0.00	338.65	7.28×10^{-5}
(vii) $\psi_1 > \psi_2 > (1-\psi_1 - \psi_2)$	16.42	11941.00	0.31	16.92	13292.70	1.21
(viii) $\psi_2 < (1-\psi_1 - \psi_2) < \psi_1$	2.65	32235.80	2.30	6.98	141964.00	0.00
(ix) $(1-\psi_1 - \psi_2) > \psi_1 > \psi_2$	0.00	83.67	0.00	0.00	119.10	0.00
Note: All values are in percentages.						